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Gender Wage Distributional Gap: A New Approach for the Gender Wage Gap Applied to Ecuador

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RESUMEN

Este trabajo de investigación tiene como objetivo analizar el comportamiento de la brecha salarial de género en el Ecuador durante la última década. Se busca analizar si, siguiendo las tendencias mundiales, la brecha salarial en el Ecuador ha disminuído entre 2007 y 2016. Como contribución principal se busca comprender la brecha salarial de género desde una nueva perspectiva, no solo estudiando las diferencias en los salarios medios entre hombres y mujeres sino que también a través de la descomposición simple de varianzas.

Palabras Clave: Brecha salarial de género, brecha salarial, brecha salarial en la distribución Oaxaca-Blinder (OB), descomposición de varianza simple.

ABSTRACT

This paper's main objective is to analyze the gender wage gap and its behavior in Ecuador for the last decade. This work studies if the gender wage gap has followed international trends, and therefore diminished between 2007 and 2016. Moreover, the main contribution is the understanding of the gender wage gap from a new perspective, through the use of simple variance decomposition.

Keywords: Gender wage gap, wage gap, gender distributional gap, Oaxaca-Blinder (OB), simple variance decomposition.

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Introduction

Work is one of the environments in which greater differences between men and women are observed. The complexity of this market is clearly reflected in wages, with men earning higher incomes than women on average. Divergent earnings have resulted in the existence of a gender wage gap that has caused more concerns and inquiry in society with the rise of feminism and the study of socio-economic development. Initially, the gender wage gap was assumed to be merely a consequence of discrimination. However, recent studies show that there are other factors such as preferences and natural characteristics of women that influence this gap.

From an economic perspective, closing the gender gap may foster development since higher wages for women would imply higher levels of money circulation in the economy, more consumption, and therefore higher wellbeing at the aggregate level. Using economic resources efficiently, in this particular case women's labor, allows a larger portion of society to better contribute to the economy as a whole. In the United States, for example, if the gender wage gap was closed it is estimated that it would grow the economy by 3 to 4% (Basset, 2012).

Considering that Ecuador is a developing country where much can be done to foster development, this paper studies how wages and their distributions have behaved during the last decade for men and women. Also, differences between men's and women's average wages and wage variances are obtained in order to calculate both the gender wage gap and the gender wage distributional gap for Ecuador.

Bearing in mind the importance of using resources efficiently, this paper might constitute an initial approach towards understanding this phenomenon at the national level and therefore contribute to the available information. Both the public and private sectors

can learn from this analysis to apply accurate and sustainable policies concerning the labor market and the division of labor in Ecuador.

Gender pay gaps are the result of complex interactions between several structural factors. The gender wage gap is usually explained due to differences between men and women in aspects such as: education, labor-force participation, job selection, experience and hours worked, job training, marriage and motherhood, and occupations, industries, tasks and firms. Lately, there have been major changes in education attainments for women and in the participation of women in the labor-force (Blau and Khan, 2017) which have led to the narrowing of the gender wage gap worldwide; yet, the gap continues to exist. Gender roles have shaped production, distribution and consumption activities within nation-states and across national borders (OBrien and Williams, 2016). Social constructions regarding gender have resulted in the feminization of several tasks and occupations such as: nursing, childcare, elder care and others. Due to this feminization of tasks, women have been actively participating in activities that are associated with lower economical remuneration. However, recent changes in social constructions regarding gender have also impacted positively in the closing of the gap through the evolution of occupations in which women are now employed. There has been an increasing the number of women participating in technical and mathematics-oriented occupations (Blau et al., 2014). Although several attempts towards closing the gap have been observed, it has not disappeared due to preferences and characteristics proper to women that influence the wages they earn and that cannot be changed automatically.

In order to understand the gender wage gap and its behavior, the most commonly used methodology was developed by Oaxaca (1973) and Blindar (1973). This methodology decomposes differences in wages across men and women using multivariate regression analysis (Fortin et al., 2011). The Oaxaca-Blinder (OB), studies the gender pay

gap through the comparisson of men's and women's average income. Recently, Firpo et al. (2009) have proposed a new regression method to evaluate the impact of changes in the distribution of the explanatory variables on quantiles of the unconditional (marginal) distribution of an outcome variable. However, there have been no attempts to understand the differences in wage variances for both genders. Motivated by this fact, this study analyzes not only the existent gap on average wages, but also the distributional wage gap in Ecuador through a simple variance decomposition. To sum up, this paper studies the behavior of the gender wage gap in Ecuador during the last decade using common and distributional methods in order to have a better comprehension of how wages are distributed in Ecuador and if the gender pay gap follows international trends.

Literature Review

Historically, there have existed differences between men's and women's earnings. This gender wage gap reflects higher incomes for men than for women. However, during the last few decades it has shown a decreasing trend. The gender wage gap and its recent behavior can be mostly explained by changes or trends in global perspectives that include: experience and work hours, divergent occupations, industries, tasks and firms between both genders, access to education and labor-force participation (Blau et al., 2014).

The existence of a gender wage gap has been partially explained by the fact that women, either by choice or by discriminative social constructions, posses shorter and interrupted work life (Blau and Khan, 2017). This results in less years of experience and less opportunities to get job training. Familial attitudes, social gender norms, and discrimination among educational institutions have contributed to shorter expected work

life of women. As a result of motherhood and family roles, women have historically worked for less years than men and in an interrupted manner (Juhn and McCue, 2017). Even though there exists a diminishing influence of marriage in discrimination towards women in the labor market, motherhood does not permit the closing of the gap due to the implications it has regarding absenteeism, lack of balance between work and family, costs generated to the firm, and others (Juhn and McCue, 2017). This shorter expected work life has reduced women's gains to investing in large amounts of formal schooling (Mincer and Polachek, 1974).

Also, there has been a clear divergence between occupations, industries, tasks and firms in which women are involved and those in which men are (OBrien and Williams, 2016). Even though this might be a matter of preferences and not of discrimination, it has been one of the main reasons for the existence of a gender wage gap. In terms of the discriminative component of this approach, there have been reductions in occupational segregation during the last decade, which is in fact associated with the evolution of women's education through the years (Blau and Khan, 2017). Rising college attendance by women increased their likelihood of qualifying for high-level positions. (Blau and Khan, 2017) Also, increased entry of college graduated women into higher-paying and formerly male managerial positions provided a further economic incentive for women to invest in college (Blau and Khan, 2017). However, in terms of preferences, in general women are prone to be involved in "low promotion activities" when they are asked to do so since women are more altruistic than men and believe more in common wellness (Babcock et al., 2017). Therefore, probably psychological and attitudinal characteristics of women might hinder the closing of the gender wage gap (Bertrand, 2011).

During the last decades women's access to education and the type of education received by them has experienced major changes, which has contributed significantly to

the narrowing of the gender wage gap. Traditionally men were more likely than women to attend college and beyond. However, this has changed lately. In the United States, for example, since 1980 women have caught up to men in college graduation and have subsequently surpassed them. Also, in the United States in 2011, women earned 57 percent of bachelor's degrees, 62 percent of undergraduate degrees, 61 percent of master's degrees, 51 percent of PhDs, and 49 percent of graduate degrees (Blau and Khan, 2017). Moreover, education received by women during the last few years has changed toward more mathematics and career-oriented programs which has resulted in less gender segregated college majors (Blau and Khan, 2017) and consequently in less segregated job occupations. Therefore, both an increase in the enrollment of women in higher levels of education and an increased participation of women in careers with higher expected wages have diminished the divergence between male and female earnings.

Women's labor-force attachment has increased during the last few years as a result of the increase in educational attainment and rising wages. Enrollment of women in higher levels of education and in more mathematically-oriented college majors are a major sign that women have gained more interest in participating in the labor-force (Blau and Khan, 2017). Rising wages have increased women's opportunity costs of staying home and therefore increased their desire to be part of the labor force. Also, in the last years there is a rising labor-force participation of women due to greater availability of market substitutes for classical ways of working (Blau and Khan, 2017). The improvements in household technology have led to new teleworking options which increase the opportunities for women to work despite their "natural conditions" such as motherhood (Greenwood et al., 2005). Considering that marriage and motherhood have been crucial to the existence of a gender wage gap, the development and dissemination of the birth

control pill, for example, have also increased women's opportunities to obtain jobs and to increase their work experience while postponing motherhood.

To understand the gender wage gap, the most commonly used methodology is the Oaxaca (1973) -Blindar (1973) (OB) decomposition method, which decomposes differences in wages between men and women using Mincer regressions (Ayala, 2017). This method consists of a multivariate regression analysis that allows for the simulation of alternative outcomes and the decomposition of gross differentials(Fortin et al., 2011). Oaxaca-Blinder (OB) runs a regression of both male and female wages and then calculates the difference between them, obtaining the gender wage gap resulting from both observed and unobserved factors (Vicéns, 2012). However, according to Fortin et al. (2011) there are several issues concerning OB including the fact that it involves sample selection bias as well as other problems generated by the existence of categorical bias. One of the main issues is that the intercept and indicator variable coefficients are influenced by the reference group(s) used for the indicator variable(s) in the model. Also, categorical or scalable variables do not have a natural zero, and thus the reference point has to be chosen arbitrarily (Fortin et al., 2011). The conventional practice is to omit one category which becomes the reference point for the other groups, which generates some interpretation issues even in the detailed decomposition of the composition effect (Fortin et al., 2011). Moreover, in the unexplained part of the decomposition one cannot distinguish the part attributed to group membership (true "unexplained" captured by the difference in intercepts) from the part attributed to differences in the coefficient of the omitted or base category. Despite these issues and its simplicity, Oaxaca-Blinder methodology permits the estimation of a detailed decomposition of the gender wage gap which has been very useful during the last years to comprehend the main factors influencing the gender wage gap (Fortin et al., 2011).

Although the gender wage gap is commonly studied around the world, in Ecuador there haven't been many analyses about this phenomenon. There are a few attempts to explain the wage gap. However, all of them have been done for a particular year and only comparing means between men's and women's wages. The first study done in Ecuador is a Oaxaca-Blinder decomposition to find out if the gender wage gap in Ecuador is explained due to differences in women's natural characteristics or due to differences in returns. As a conclusion, Espinoza (2008) found that during the year of study the wage gender gap was a consequence of discrimination faced by women. However, this work does not correct for endogeneity and sample selection bias. Espinoza and Sanchez (2009) conclude that the gender wage gap in Ecuador is a result of differences in jobs occupied by men and women. This work studies the gender gap in different quantiles of the population, and uses Oaxaca-Blinder with Heckman corrections to compare mean wages of both groups. Gutierrez (2011) studied the gap for 2008 and concluded that the gender wage gap is prominent at the managerial level and it increases as the wage level rises. In enterprises in which primary economic activities are conducted wage differences are evident, while in service oriented enterprises wages are similar for both genders. Again using mean decomposition, Rivera (2013), concluded that comparing 2007 with 2012 the gender wage gap in Ecuador fell from 15.1% to 10.1%. At a provincial level Carchi and Largo (2014) observed through a Oaxaca-Blinder model that in 2012 the gender wage gap in Cuenca was principally caused by discrimination towards women. As well as most of the research done in Ecuador, there were no corrections done to avoid sample selection bias. Furthermore, Pérez and Torresano (2015) using Oaxaca-Blinder, Neumark (1988), Machado and Mata (2005) and Juhn et al. (1993) methods, determined that in 2013 the gender wage gap was 0.08 logarithmic points explained merely by the discriminatory component towards women and

that if this is compared with 2007, there has been a reduction in the gap. The last study done regarding the gender wage gap in Ecuador consists of a semiparametrical study of the gender gap (Ayala, 2017). The purpose of this methodological approach is to correct the main limitations of the classical Oaxaca-Blinder (OB) by implementing a Tobit III model. The results showed a decrease in the gender pay gap up to 2010. From 2014, however, there exists a major increase thereof.

Considering the main issues of Oaxaca-Blinder (OB) and the limited number of studies on the gender wage gap in Ecuador, it is useful to go one step further and study the difference not only of mean wages but the *differences in wage distributions* through simple variance decompositions. The purpose is to provide a first view at how variance in wages has changed over time in Ecuador. One of the main convenient features of the variance is that it can be decomposed into within and between group components (Fortin et al., 2011) which can better help us understand economic mechanisms such as the sources of inequality (Juhn et al., 1993). However, the main drawback of the between vs. within approach is that it does not provide a straightforward way of looking at the specific contribution of each covariate, i.e. to perform a detailed decomposition. Despite this caveat, variance decomposition does have the advantage of showing the contribution of explained and unexplained factors to the gender wage distribution gap.

Methodology, Data & Variables

3.1 Methodology

We analyze the gender wage distributional gap. The starting point for this purpose is a simple variance difference analysis. Although this cannot explain the contribution

of each particular variable to the difference between each gender's wage variances, it provides a general perspective of what actually happens in wage distributions for men and women in Ecuador in terms of the explained and unexplained part of the gender wage distributional gap (Fortin et al., 2011). The same procedure is conducted for years of education in order to find consistent explanations for the obtained gender wage distributional gap.

The first step for this analysis consists of obtaining the variance of both variables of interest for each gender in Ecuador. The variance is defined as a measure of spread in the distribution of a random variable (Wooldridge, 2013). In this case the random variable is defined as y_g, which is defined as wages corresponding to gender $g \in \{m,w\}$. Its expected value is defined as $E(y_g) = \mu_g$, which is simply the average. Understanding the distribution of y_g involves the study of how much each individual i's wage y_{ig} deviates from its expected value $E(y_{ig})$. The variance for each gender's wages is is thus defined as:

$$\sigma_g = \frac{1}{n_{ig}} \sum (y_{ig} - \mu_g)^2, \tag{1}$$

where σ_g is the variance of y for each group (men or women), n_{ig} corresponds to the number of men or women in the sample, and $(y_{ig} - \mu_g)^2$ is the squared difference between y_{ig} and the average μ_g of the sample for each gender. The squaring eliminates the sign from the distance measure. The square root of the variance σ_g corresponds to our intuitive notion of distance, and treats values above and below μ symmetrically (**?**). Thus, the main purpose of using the variance for this study is obtaining the expected distance of income from its mean, and therefore how far wages are spread out for both men and women. A variance of zero means that there is no variability among the data

set and that all the values are equal in the sample; a higher variance means that the data set is highly spread out (**?**).

To analyze the difference between each gender's σ_g, a Oaxaca-Blinder (OB) model is developed. This model diverges from the classical Oaxaca-Blinder (OB) model since the compared variable is σ_g and not μ_g. Classical Oaxaca-Blinder's (OB) starting point is a multivariate regression defined as:

$$ln(y_{ig}) = V'_{ig}\beta + e_{ig} \tag{2}$$

$$g = m, w,$$

where y_{ig} is wages for individual i for each group, V'_{ig} is vector of individual's characteristic, β is the vector of coefficients and e_{ig} is the error. Once the estimation of the dependent variable for each group is obtained, Oaxaca defines the difference Δ as:

$$\Delta = \frac{y_m - y_w}{y_w} \tag{3}$$

Taking logarithms on both sides:

$$ln(\Delta + 1) = ln(y_m) - ln(y_w) \tag{4}$$

Substituting y_m and y_w:

$$ln(\Delta + 1) = V'_m\beta_m - V'_w\beta_w \tag{5}$$

An therefore:

$$ln(y_m) - ln(y_w) = \beta_w(Z'_m - Z'_w) + Z'_m(\beta_m - \beta_f) \tag{6}$$

As mentioned above, for this purpose the gender wage distributional gap is obtained through the same procedure but instead of working with the average y_g, σ_g is used.

3.2 Data

The data on structural factors that affect the behavior of the gender wage distributional gap are obtained from the ENEMDU which is an employment survey carried out in Ecuador by its National Institute of Statistics and Censuses (INEC). The ENEMDUs cover a wide range of economic and socio-demographic information such as labor data, different sources of income, housing, migration, education, and other social indicators, and are used mainly to estimate labor market indicators such as unemployment and underemployment (Gachet et al., 2017). Even though since 2007 this survey has appeared quarterly for urban households, for the purpose of this paper only December ENEMDUs (which include both urban and rural households) are used in order to make a yearly analysis of the gender wage distributional gap from 2007 to 2016.

The data obtained from surveys, such as the ENEMDUs, provides important information about the national labor market. However, the outcomes of this kind of surveys depend crucially on the expansion factors attached to the responses of individual households (Kaiser et al., nd). Therefore, considering that the ENEMDUs provide information for a limited sample of households, expansion factors (previously calculated by the INEC) are used in order to obtain relevant results about the behavior of the gender wage distributional gap that can be associated with the whole Ecuadorian population and not only the sample covered by the survey.

Even though the ENEMDUs provide a significant amount of information regarding the Ecuadorian labor market, these surveys posses various limitations once it is used for

econometric studies. The main issue is that some variables cannot be included since there are missing values. As a result, if those variables are included in the modeling, the sample size is reduced dramatically. For this particular study the variables that could not be included due to this limitation are: work hours, occupation group (which reflected the kind of activity in which the respondent works) and job type that could be used as a proxy for working hours. Moreover, another limitation of the ENEMDUs is that sometimes data provided by respondents is not accurate.[1]

The variables included in the model are selected based on the previous literature regarding the gender pay gap and the availability of these variables in the ENEMDUs. To calculate the difference between men's and women's wages, demographic, occupational, educational and familiar variables need to be included in order to control for the individual effects that each of them might have in the wage gap.

As this paper aims to study the gender wage distributional gap, the dependent variable is labor income. This variable is obtained from the ENEMDU of each year. However, several modifications are made in order to work with it and obtain consistent results. There exist two descriptive categories, denominated "spends more than income earned" and "does not inform", which are not included in this model since they do not reflect a real income value. In addition, bearing in mind that the objective is to compare wages between those that are engaged in the labor market and that in fact perceive a monthly income, incomes of 0 are dropped from the sample. If these incomes were included, there would be an overestimation of the gap, leading to incorrect conclusions. Finally, the whole study is carried out using the logarithm of income. This is a common practice in the literature related to the gender pay gap since once logarithms are

[1]While developing the study several inconsistencies were found. For example, one person reported earnings of 14000 and also mentioned that was a non remunerated employee.

applied the distribution of income becomes closer to a normal distribution and there is no problem dealing with extreme values.

The demographic variables included in this model are: age, race and area. These variables are included because they can by themselves explain part of the gender pay gap. For instance, in terms of race, Hegewisch et al. (2017) show that in the United States both men and women in all major races and ethnic groups, except for black, experienced increasing or at least stable earnings. But, women from all major races earned less than men from the same group, except for White workers who experienced more similar earnings (Hegewisch et al., 2017). Regarding age, for this study only people aged 15 and over are considered since in Ecuador this is the legally defined lower bound for the economically active population. It is important to include this variable since part of the wage gap can be explained by the differences in ages at which men and women reach their higher earnings. Finally, the variable area is also included since people working in urban areas tend to have higher incomes than those living in rural areas.

In the same way as demographic variables, variables related to family structure may explain by themselves part of the existing wage gap. Therefore, marital status and kinship relationship are included in the model. Marital status has an important contribution in the gender gap since, in the United States for example, the gender gap is generally less than 10% among single men and women but among married men and women it increases to 30% or 40% (Polachek and Xiang, 2014). Marriage affects women's earnings negatively and men's earning positively. The reason is that while marriage for women imply a higher probability of motherhood, for men it signals more responsibility. Kinship relationship also affects the gender pay gap magnitude since usually the head of household has higher earnings than the rest of the family. However, this variable in

ENEMDU's case might not be accurate since the kinship relationship is a matter of self-denomination according to what the respondent feels identified with, instead of being assigned to the respondent according to pre-stablished parameters.

Finally, educational and occupational variables are included in the model to control for their possible individual effects over the gap. We include years of education and occupation category. It is important to include years of education in the model since more years of education result in higher probabilities of participating in the labor market as well as higher wages (Blau and Khan, 2017). Therefore, higher education attainment implies higher returns on education reflected principally on wages and on the kind of occupations. Occupation category is a variable obtained from the ENEMDUs and is composed of several dummy variables that reflect whether the respondents are public or private workers, if they are only day laborers, if they are bosses, or if they own their own businesses. It is important to include this variable because, for example, in Ecuador public worker earn higher wagers than private ones.

Results

4.1 Classical Oaxaca-Blinder (OB) for income and years of education

Before working with variances, in order to understand how the gender pay and educational gaps have behaved and if this behavior follows international trends, a simple Oaxaca-Blinder (OB) model, without corrections, is carried out for both income and years of education. This procedure allows for a comparison of the average income and years of education between genders during the last ten years in Ecuador. Even though

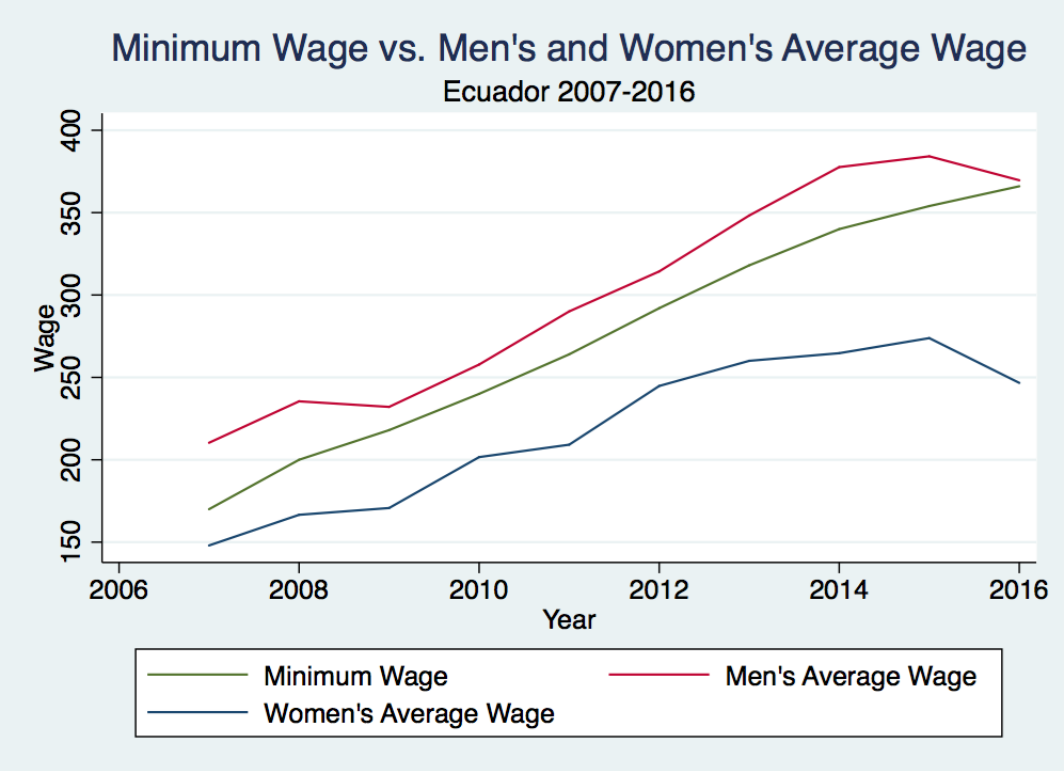
Table 1: Ecuadorian Minimum Wage, Men's and Women's Average Income, and Gender Wage Gap

Year	Minimum Wage	Men's Average Wage	Women's Average Wage	Gender Wage Gap
2007	$170.00	$210.33	$148.00	$62.33
2008	$200.00	$235.49	$166.61	$68.88
2009	$218.00	$232.09	$170.72	$61.38
2010	$240.00	$257.80	$201.61	$56.18
2011	$264.00	$290.04	$209.15	$80.89
2012	$292.00	$314.32	$244.79	$69.53
2013	$318.00	$348.26	$260.06	$88.20
2014	$340.00	$377.63	$264.70	$112.93
2015	$354.00	$384.18	$273.84	$110.34
2016	$366.00	$369.63	$246.66	$122.97

both are simple models, the results are supported by previous work done in Ecuador by Ayala (2017) and Gachet et al. (2017). These studies provide evidence consistent with the general trends obtained by the classical Oaxaca-Blinder model and support subsequent conclusions.

The first model analyzes mean income for both genders. From this model it can be seen that during the last decade the average income for both men and women has increased. Men's average income rose from $210.33 in 2007 to $369.63 in 2016 and women's average income rose from $148.00 in 2007 to $246.66 in 2016. Overall, this represents an increment of 75.74% for men and 66.67% for women. Even though a similar trend is observed for both groups of study (see Table 1: Ecuadorian Minimum Wage vs. Men's and Women's Average Income), the geometric average annual wage growth rate has been higher for men (6.47%) than for women (5.84%). This may be one reason why the gender pay gap has not closed in Ecuador, as we discuss below. Moreover, for the whole period of study men's wage is higher than women's which

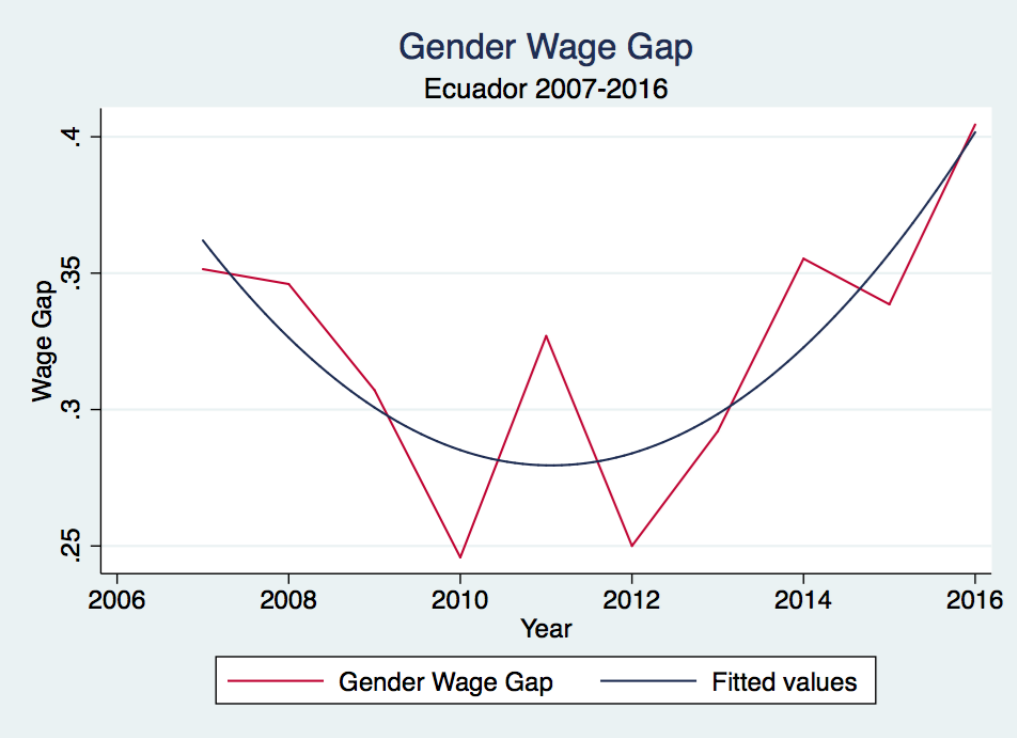
Figure 1: Ecuadorian Minimum Wage vs. Men's and Women's Average Wage



shows a persistent inequality between men and women in the Ecuadorian labor market. During the ten years women's average wage income has been between 67% and 78% of men's wage income.

This becomes more evident once both average wages are compared with the Ecuadorian minimum wage (see Figure 1: Ecuadorian Minimum Wage vs. Men's and Women's Average Wage), which according to the Ecuadorian Labor Ministry (2016) is defined as "a worthy wage that at least covers the basic needs of working people and their families". During the last ten years, men's average income has been above the minimum wage while women's has always been below it. In fact, during the last decade men's mean wage has been on average $25.78 above the Ecuadorian minimum wage while

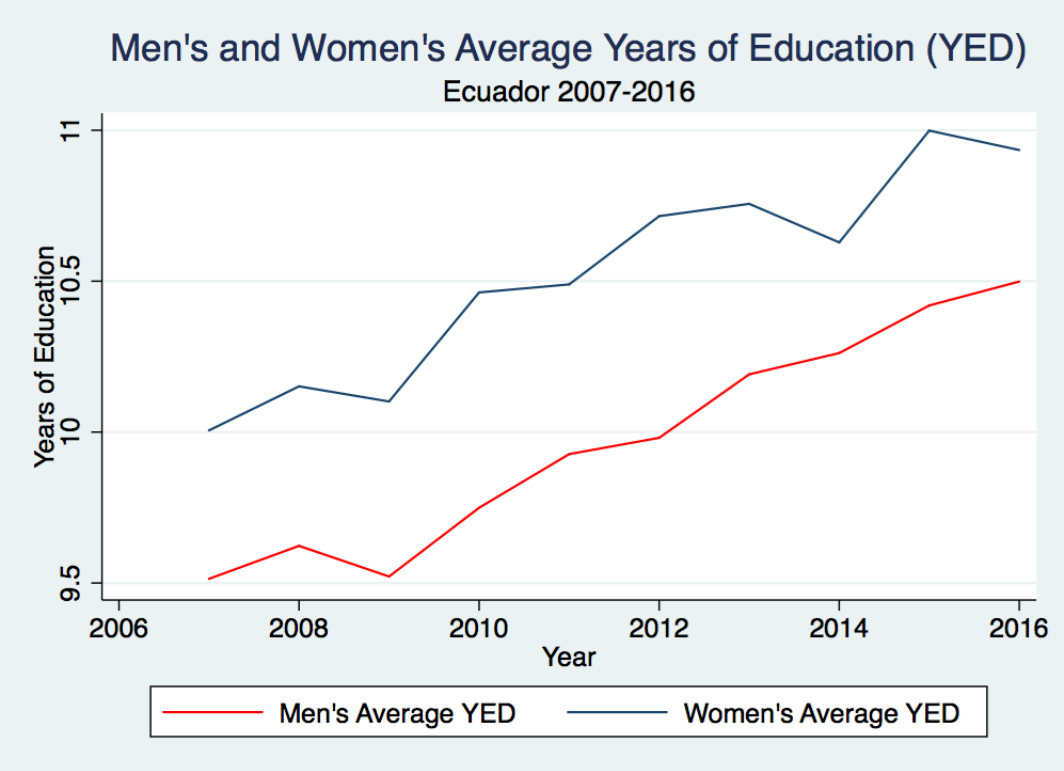
Figure 2: Gender Wage Gap



women's has been $57.59 below. In 2016 there is a clear drop in both men's and women's. Compared with 2015, year in which wages reached their maximum level, there was a drop of 3.79% for men and 9.93% for women. As a result, the difference between women's average wage and Ecuadorian minimum wage increased and the difference between men's average wage and the minimum wage became smaller. Also, from 2012 to 2015 there is a clear difference in men's and women's wage growth rates. While men's wages increased $33.94 for 2013, $29.37 for 2014 and $6.55 for 2015; women's wages increased $15.27, $4.64 and $ 9.14 for the same years. Regarding the wage gap, the data presented above clearly shows that there exists a positive gap since men's average wage is significantly higher than women's (see Figure 2: Gender Wage Gap). During the last decade there have been two clear periods. From 2007 to

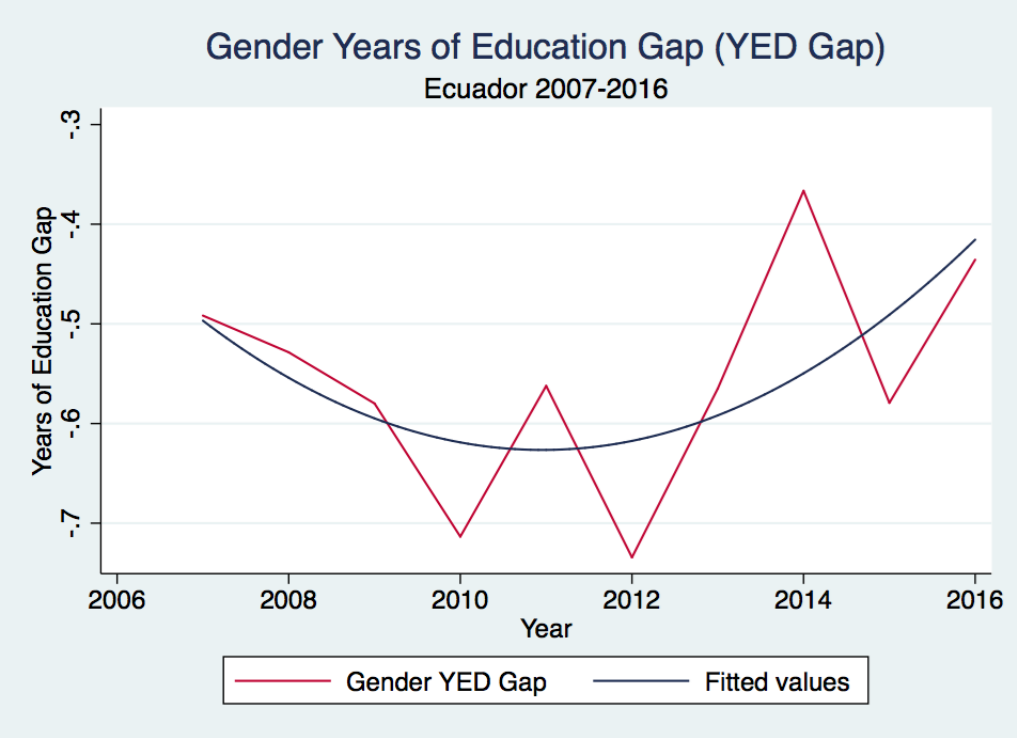
2012 the gap narrows, reaching its lowest point in 2012. Then from 2012 to 2016 it widens again reaching its peak of the decade in 2016.This trend is clearly seen in the quadratic fit which is convex and has its minimum in 2012, year in which macroeconomic stability was initially threatened in Ecuador.We expected a similar behavior in the Ecuadorian gender wage gap relative to foreign wage gaps. However, in Ecuador it seems that other factors, different from the structural ones included in this model, are influencing in the labor market and therefore creating this divergence with the international experience which shows a continuous narrowing of the gender wage gap as a result of more educational attainments for women, less job-type gender segregation, access to new technology and working modalities, and others (Blau and Khan, 2017). Even though the Oaxaca-Blinder (OB) model presented here does not posses any kind of corrections, these results are validated comparing them with Ayala (2017)'s analysis. For the same period of study her model also reflects initially a fall of the gender wage gap from 2007 to 2012, and from then on shows the opposite trend, with 2012 representing the breaking point. Bearing in mind that during the last decades the closing of the gender wage gap has been explained mainly by higher levels of education perceived by women (Blau and Khan, 2017), a classical Oaxaca-Blinder (OB) model is carried out for years of education to try to explain what was previously observed for the gender pay gap in Ecuador. This model, as well as the one developed for income, was carried out for a particular group of study which only includes individuals over the age of 15 (legal age to work in Ecuador), with income higher than 0 and that are occupied in the labor market. For this particular sample, we see a positive trend in years of education for both men and women during the last decade (see Figure 3: Men's and Women's Average Years of Education(YED)). In fact, in 2016 men had 0.98 years more of education than in 2007 and women attained 0.93 additional years.

Figure 3: Men's and Women's Average Years of Education (YED)



Finally, we can observe that during the last ten years occupied women in Ecuador have been *more* educated than men, which leads to a *negative* education gap (see Figure 4: Gender Years of Education Gap (YED Gap)). On average women have had access to one-half year more of education than men. Even though women on average study more years than men, the increase in years of education between the first and last year of study is higher for men than for women. As well as in the case of the gender wage gap, for Ecuador, 2012 is a breaking point in the trend. From 2007 to 2012 the gap increases, meaning that during this period of time years of education attained by women are even higher than men's. However, from 2012 to 2016 there is a closing of the gap which means that the difference of years of education between men and women falls.

Figure 4: Gender Years of Education Gap (YED Gap)



4.2 Income and Years of Education Variance Gap

Taking into consideration that this paper's main objective is to have an initial approach towards the study of wage distributions for both genders, a similar model as the one carried out for means is applied to the variances. To begin with, income variance is calculated for each gender in order to comprehend how wages are distributed and in particular to understand how far they are from the average wage. From this it was expected to observe a higher income variance for men than for women since the top income are often earned by men. However, for the decade of study, the opposite is observed. As time passes men's income variance diminishes, showing a decreasing linear trend. Men's income variance has decreased from 0.97 in 2007 to 0.78 in 2016.

Figure 5: Men's and Women's Income Variance

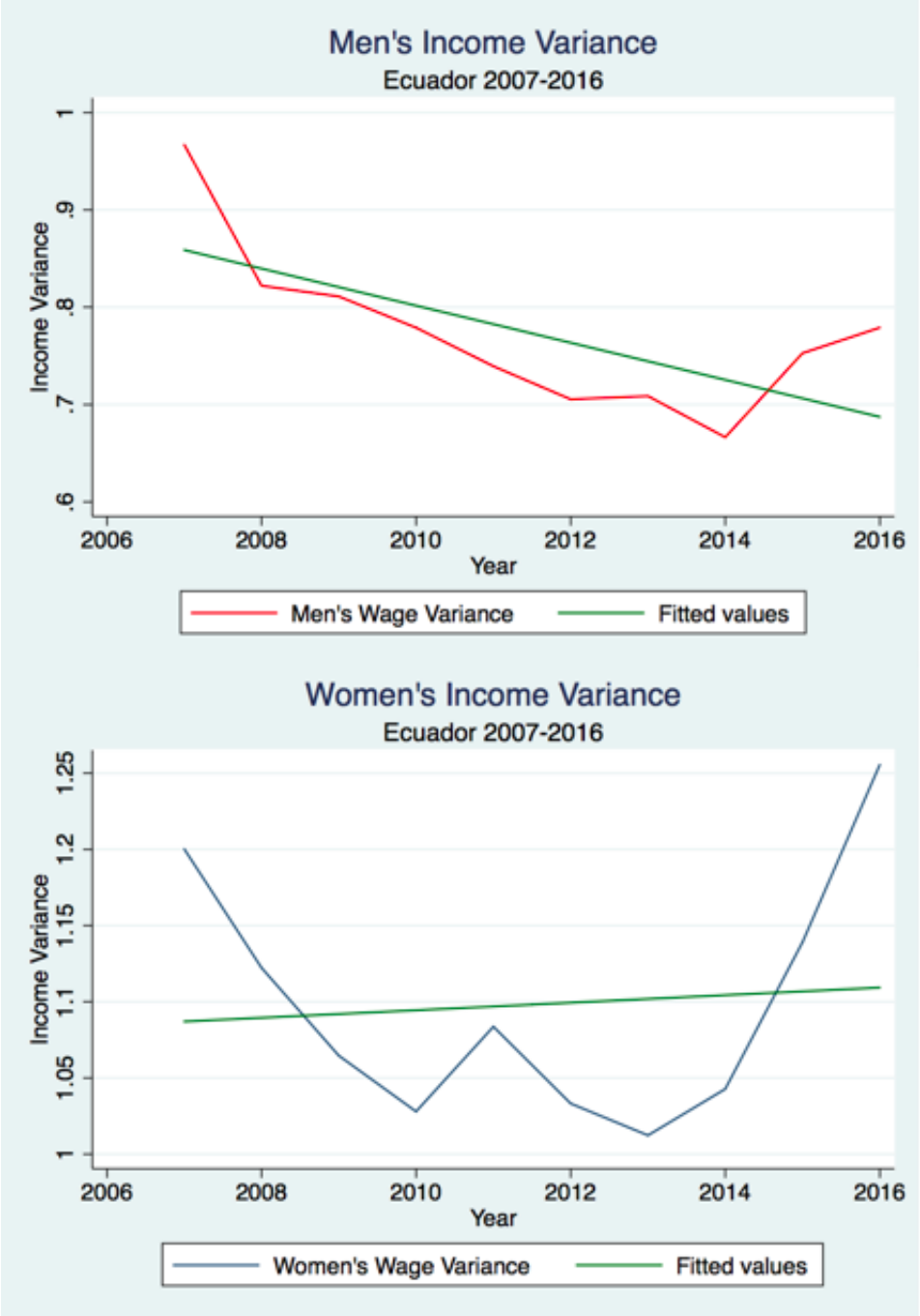
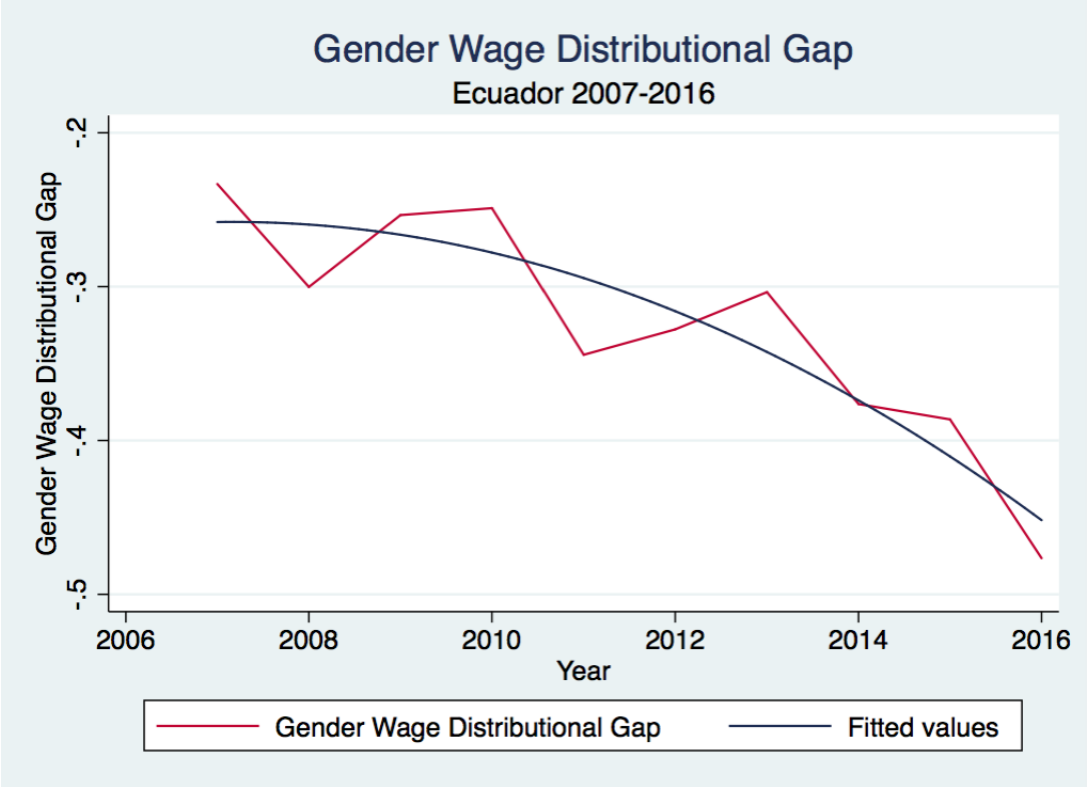
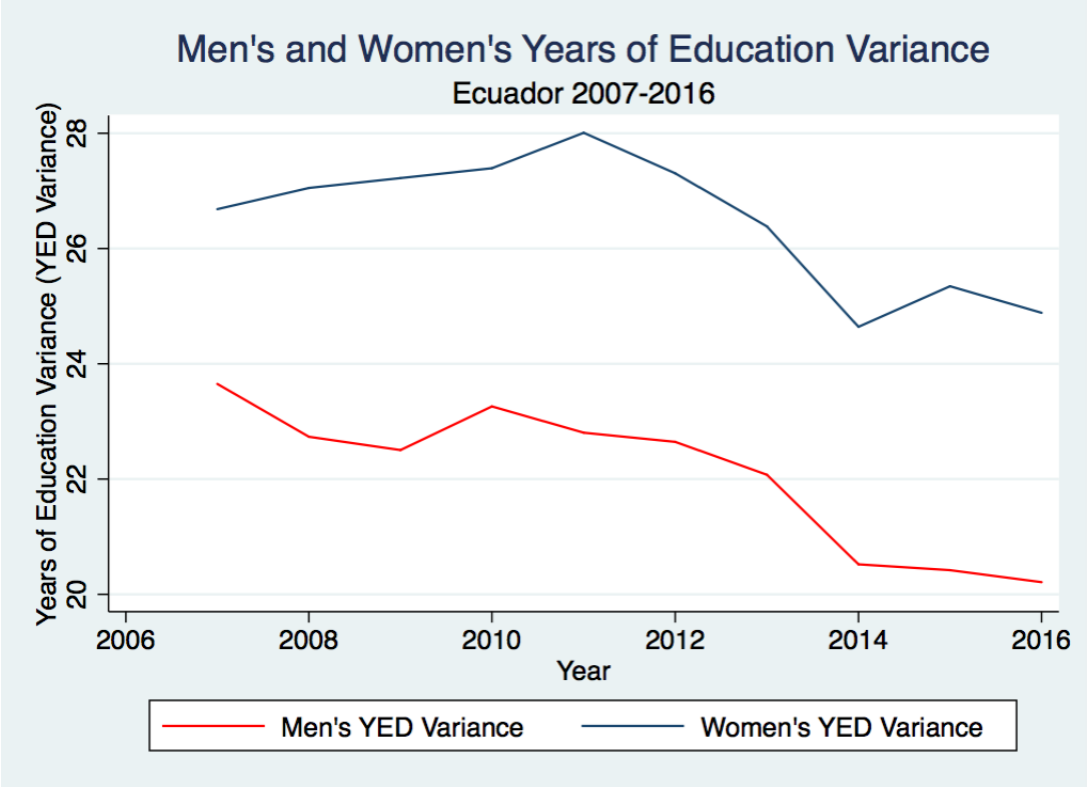


Figure 6: Gender Wage Distributional Gap



From 2007 until 2012 men's income variance diminishes and from then on it goes slightly up until 2016. However, it never reaches its highest level, which was observed in 2007 (see Figure 5 – Men's and Women's Income Variance). Both genders' income variance have opposite trends. While women's income variance increases over time, men's income variance decreases. However, women's wage variance is slightly more stable when the overall "growth rates" are compared. Between 2007 and 2016, men's income variance decreases by 19.43% while women's income variance increases by 4.61%. Moreover, bearing in mind that women's income variance is *higher* that men's, a negative gender gap is observed. Over the period of analysis, this gap becomes more negative, which reflects that in fact women's wages are more spread out from the average

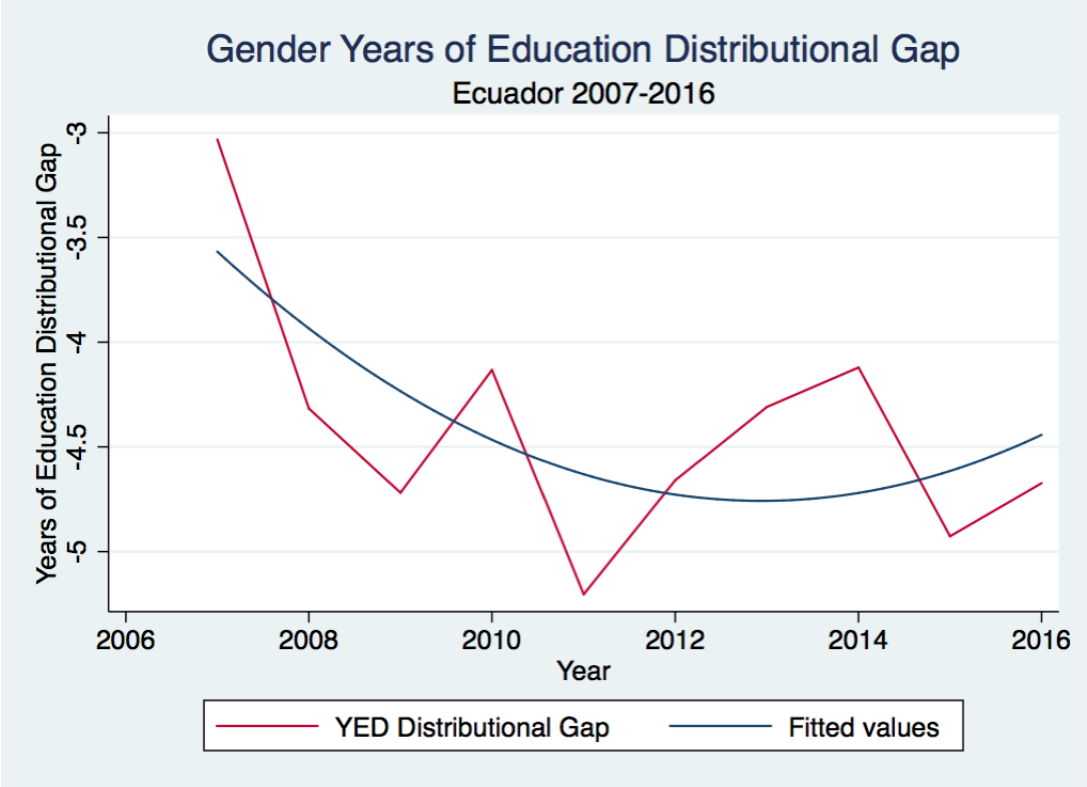
Figure 7: Men's and Women's Years of Education Variance



wage than men's. In 2007 the gender wage distributional gap was -0.23 while in 2016 it became -0.48, meaning that the gap approximately doubled during the last ten years (see Figure 6 - Gender Wage Distributional Gap).

As in the previous section, the same procedure is done for years of education. In this case both men's and women's years of education variance is decreasing. Even though years of education variance is also higher for women than for men, a similar behavior is seen for both gender variances (see Figure 7: Men's and Women's Years of Education Variance). For men education attainment variance has passed from being 23.65 in 2007 to 20.21 in 2016, while for women it has passed from 26.68 to 24.88. While men's education variance has dropped at a rate of 14.54%, women's has decreased in 6.67%

Figure 8: Gender Years of Education Distributional Gap



In conclusion, women's years of education variance has also been higher than men's, resulting in a negative gap. As the rate at which years of education variance diminishes is higher for men than for women, over time the gap also becomes more negative. In 2007 the educational variance gap was -3.03 and in 2016 it reached one of its highest levels at -4.67. As a result, the variance gap for years of education has increased in a 54.13% between 2007 and 2016 (see Figure 8: Gender Years of Education Distributional Gap).

Discussion

5.1 Average Income and Years of Education

The last 12 years in Ecuador the gender educational gap for the whole population reflects that men have on average more years of education than women, therefore resulting in a positive gap that declines slowly but consistently over time. For 2005 the gap was 0.21 years, falling to 0.08 years in 2015 and almost disappearing for 2016 (Gachet et al., 2017). According to Gachet et al. (2017), this finding is an important milestone regarding gender inequality as it means that on average women are acquiring a very similar level of education as men.

However, this paper provides a new contribution regarding gender inequality in education. For this particular case of study, when the sample is restricted to those attached to the labor force and that have an income higher than 0 the gap becomes negative and increasing over time. Therefore, among those qualified as "occupied" in the Ecuadorian economy, women show higher levels of education than men and as this becomes more evident over time. Internationally, the recent increase in women's labor-force attachment is explained as a result of higher educational attainments. Moreover, enrollment of women in higher levels if education is a major sign that women have gained more interest in attaching to the labor-force (Blau and Khan, 2017). Even though for this particular sample women have more years of education than men, they clearly perceive a lower average wage than men. According to Asaf et al. (2009) sizable literature indicates that female occupations pay less than male occupations for workers with similar measured characteristics. Therefore, in order to have similar income levels, women need to acquire more skills in order and differenciate from men. The increase of al-

most 1 year of education, and the fact that during the whole period of study women have shown almost half a year more of education, is coherent with trends seen in the United States where lately women have caught up to men in college graduation and subsequently they have surpassed them (Blau and Khan, 2017). However, for Ecuador, the data reveals that once attached to the labor force, women need more years of education in order to earn the same wage as men.

During the last few decades the fall of the gender pay gap has been principally explained by the closing of the education gap at an international level. Although in Ecuador the gender pay gap has not had a continuous decreasing trend, the fact that the gender educational gap and the gender pay gap both show the same trend during the whole period may reflect a relationship between years of education and wages. When women achieve higher levels of education the educational gap becomes more negative and the gender pay gap decreases. For Ecuador this only happened duirng the five-year period between 2007 and 2012 when the macroeconomic situation was stable. The opposite happens when women acquire lower levels of education. In this case, the educational gap becomes less negative, and the pay gap increases. In 2012, when the Ecuadorian macroeconomic situation started to deteriorate, there existed a breaking point for both gaps.

One of the main characteristics of the division of labor is that women are highly engaged in domestic and caring activities that are usually less valued that other kinds of occupations that require more technical or managerial skills (OBrien and Williams, 2016). The devaluation of women's labor usually implies lower wages for this kinds of occupations and deepen the gender wage gap. This is clearly seen in the Ecuadorian case since on average for the whole period of study the number of women engaged in

Table 2: Distribution of Men and Women by Activity

Distribution of Men and Women by Activity

Non-remunerated Activities

Year	Men	Women	Men/Women Ratio	% of Men from the Sample	% of Women from the Sample
2007	1463	2919	2.00	0.06	0.12
2008	1234	2677	2.17	0.05	0.10
2009	1386	2728	1.97	0.05	0.10
2010	1336	2621	1.96	0.05	0.09
2011	858	1875	2.19	0.04	0.07
2012	1045	2162	2.07	0.04	0.08
2013	1079	2473	2.29	0.04	0.09
2014	2016	4452	2.21	0.05	0.11
2015	2157	4373	2.03	0.06	0.11
2016	2596	5403	2.08	0.07	0.13
Average	1517	3168.3	2.10	0.05	0.10

Domestic Activities

Year	Men	Women	Men/Women Ratio	% of Men from the Sample	% of Women from the Sample
2007	57	846	14.84	0.00	0.03
2008	37	866	23.41	0.00	0.03
2009	59	891	15.10	0.00	0.03
2010	37	812	21.95	0.00	0.03
2011	45	611	13.58	0.00	0.02
2012	37	659	17.81	0.00	0.02
2013	47	795	16.91	0.00	0.03
2014	46	1043	22.67	0.00	0.03
2015	47	933	19.85	0.00	0.02
2016	45	1114	24.76	0.00	0.03
Average	46	857	18.75	0.00	0.03

domestic remunerated activities is approximately 19 times higher than the number of men in this occupation (see Table 2: Distribution of Men and Women by Activity).

Finally, in line with international trends, women in Ecuador are more likely than men to be engaged in non-remunerated activities. In fact, in Ecuador women are 2.10 times more engaged than men in this kind of activity (see Table 2: Distribution of Men

Table 3: Men's and Women's Wage Variance and Gender Wage Distributional Gap

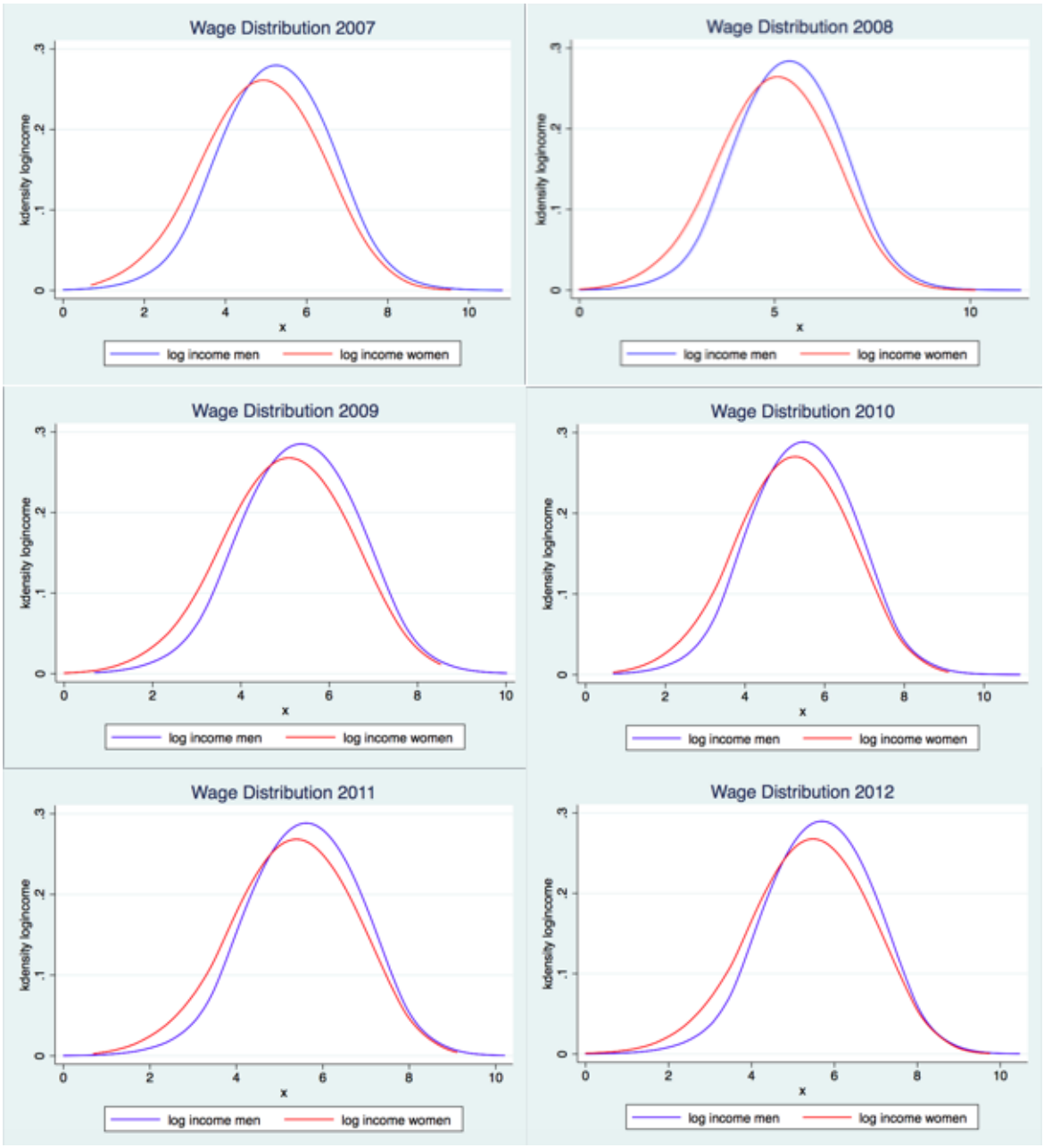
Year	Men's Wage Variance	Women's Wage Variance	Gender Wage Distributional Gap
2007	0.97	1.20	-0.23
2008	0.82	1.12	-0.30
2009	0.81	1.06	-0.25
2010	0.78	1.03	-0.25
2011	0.74	1.08	-0.34
2012	0.71	1.03	-0.33
2013	0.71	1.01	-0.30
2014	0.67	1.04	-0.38
2015	0.75	1.14	-0.39
2016	0.78	1.26	-0.48
Growth Rates	-0.19	0.05	1.04

and Women by Activity). Therefore, the social constructions created around gender and the feminization of certain types of occupations does not allow the gender wage gap to close.

5.2 Income and Years of Education Variance

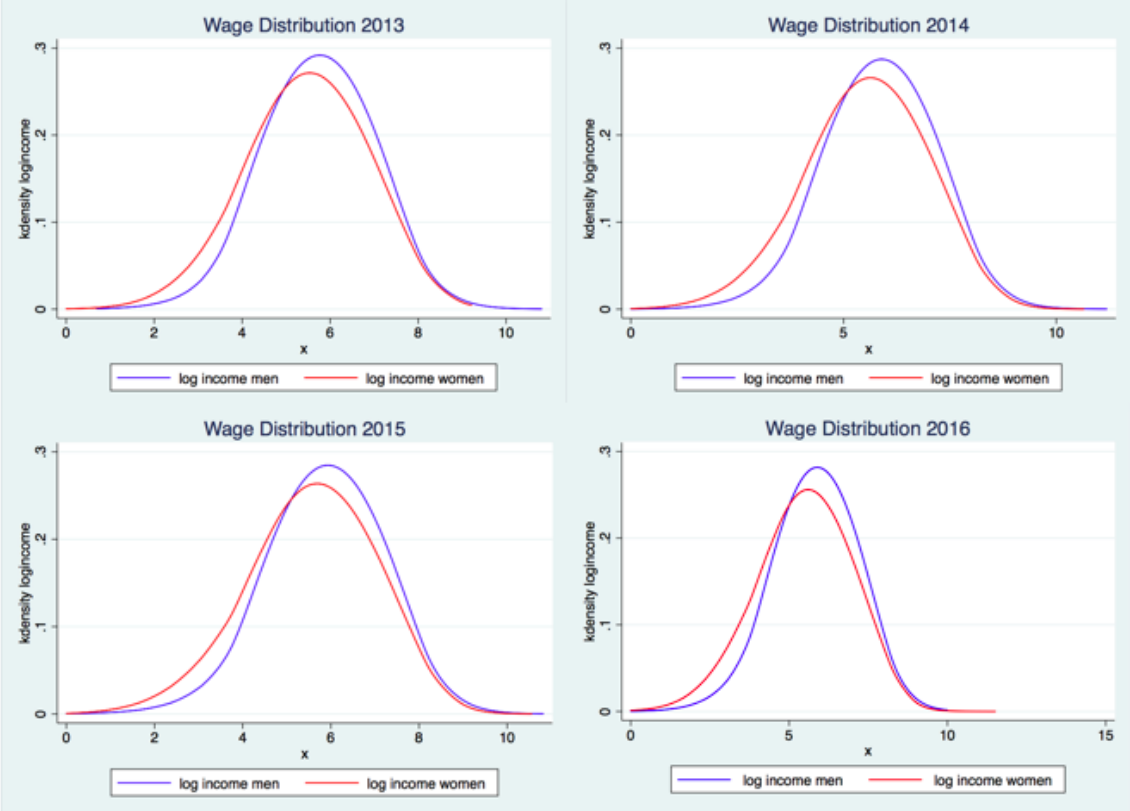
When the wage distribution of both genders is analyzed for Ecuador, it is clear that average wages are lower for women than for men, supporting what was obtained from the classical Oaxaca-Blinder (OB) model. However, in terms of variances, different results from the expected are obtained. Bearing in mind that we expected to observe a higher concentration of women with lower incomes at the right part of the distribution, lower variances were also expected for women than for men. However, for the Ecuadorian case higher variances are seen for women than for men (see Table 3: Men's and Women's Wage Variance and Income Gap). Therefore, a negative gender wage distributional gap is observed for the ten years of study.

Figure 9: Wage Distributions 2007-2012



Wages are highly concentrated around the mean for men, narrowing their income distribution, while for women wages are spread on a wider range around the mean. For

Figure 10: Wage Distributions 2013-2016



women we observe more commonly cases in which they earn large amounts both above and below the average (see Figure 9: Wage Distributions 2007-2012 and Figure 10: Wage Distributions 2013-2016).

There are two measures of shape that explain this behavior of the wage distributions: kurtosis and skewness. For this particular case, kurtosis results more evident since it is explained in terms of the central peak where more differences are seen between men and women. An increasing kurtosis reflects the movement of probability mass from the shoulders of a distribution into its center (Balanda and MacGillivray, 1988). Higher kurtosis implies that variance is mostly a result of infrequent extreme deviations, while a

Table 4: Income Distribution - Skewness and Kurtosis

Year	Kurtosis		Skewness	
	Men	Women	Men	Women
2007	4.70	3.33	-0.19	-0.35
2008	4.57	3.48	-0.12	-0.42
2009	4.63	3.39	-0.20	-0.42
2010	4.78	3.85	-0.15	-0.50
2011	4.66	3.51	-0.44	-0.57
2012	5.22	4.04	-0.43	-0.73
2013	5.16	3.76	-0.23	-0.59
2014	5.26	3.93	-0.35	-0.69
2015	5.67	3.85	-0.55	-0.74
2016	5.20	3.51	-0.60	-0.62

lower kurtosis reflects non-extreme deviations from the average (Westfall, 2014). In the case of Ecuador, the women's sample presents more frequent deviations from the mean resulting in lower kurtosis than men. Hence, during the whole decade men's kurtosis is higher than women's, which explains why men's central peaks of the distribution are higher than women's and why women's distribution is wider than men's (see Table 4: Income Distribution - Skewness and Kurtosis).

Skewness on the other hand represents to what side the distribution is more heavy tailed. There is a positive skew if the right tail is longer and data is highly concentrated in the left, and a negative skewed if the left tail is longer and data is concentrated on the right. Considering that for this particular case the sample was restricted to income levels higher than zero there is no possible skew to the right. Therefore, for both genders we observe a negative skew (skew to the left). As women's average income is to the left of men's because it is lower, there is also a more negative skew on their distribution meaning that the left tail is longer (see Table 4: Income Distribution - Skewness and Kurtosis). However, even thought women's distribution appears to be more heavy tailed to the left than men's, for the whole period of study, men's maximum wage is higher

Table 5: Men's and Women's Years of Education Variance

Year	Men's YED Variance	Women's YED Variance	Education Distributional Gap
2007	23.65	26.68	-3.03
2008	22.73	27.05	-4.32
2009	22.50	27.22	-4.72
2010	23.26	27.39	-4.13
2011	22.80	28.01	-5.21
2012	22.65	27.31	-4.66
2013	22.07	26.38	-4.31
2014	20.52	24.64	-4.12
2015	20.42	25.35	-4.93
2016	20.21	24.88	-4.67

than women's. The right tail shows this since it is always longer for men than for women (see Figure 9: Wage Distributions 2007-2012 and Figure 10: Wage Distributions 2013-2016).

Since we found a clear relationship between average wages and average years of education above, the same analysis that was carried out for income variance is conducted for years of education. In the same way as income, higher variances are registered for women's distribution of years of education than for men's. Therefore, the gender education distributional gap is also negative (see Table 5: Men's and Women's Years of Education Variance).

In this particular case, as average years of education are less divergent than average earnings for both genders, kurtosis and skewness are not as evident as they were for income. For the whole period of study, men's distribution has a higher kurtosis than women's (see Table 6: Years of Education Distributio - Skewness and Kurtosis). Men's years of education are highly concentrated around the average, while women's are spread on a wider range. Therefore, in Ecuador, men have on average similar educa-

Table 6: Years of Education Distribution - Skewness and Kurtosis

Year	Kurtosis		Skewness	
	Men	Women	Men	Women
2007	4.70	3.33	0.19	-0.35
2008	2.56	2.37	0.06	-0.02
2009	2.54	2.35	0.05	-0.06
2010	2.51	2.33	-0.00	-0.09
2011	2.52	2.36	-0.08	-0.13
2012	2.51	2.32	-0.10	-0.15
2013	2.55	2.41	-0.09	-0.15
2014	2.64	2.51	-0.09	-0.14
2015	2.64	2.54	-0.13	-0.23
2016	2.68	2.58	-0.16	-0.24

tion attainment and years of education. Women, on the contrary, show higher variability. While there is a group of highly educated women which might have higher wages and better job positions, there is also a group of women who cannot access education and as a result lack of opportunities to participate in the labor force and grow professionally.

Finally, regarding skweness, men's distribution is more similar to a normal distribution than women's since its values are more proximate to 0. For men's years of education, between 2007-2009 the distribution is right skewed and from the on it becomes negative. In women's case, the distribution is left skewed for the whole period of study. A negative or left skew means that data is highly concentrated in the right part of the distribution and that the left tail is longer than the right. Therefore, for both groups, the is only a small number of people that report unusually high education attainment compared to the rest of the sample.

Conclusion

This paper studied the gender wage gap in Ecuador for the last decade both from a mean perspective and a distributional perspective. Using the classical Oaxaca-Blinder (OB) methodology, we compared whether the gender wage gap in Ecuador has followed international trends or not. In addition, a variance decomposition is carried out following Firpo et al. (2009) analysis on new approaches to study wage gaps. This is a new contribution to the Ecuadorian gender gap literature, providing a new dimension from which wage differences can be studied.

We conclude that for the first five years of study (2007-2012) the Ecuadorian gender pay gap follows international trends. During this period the gap showed a decreasing trend when comparing men's and women's average income. However, during the following five years this trend reverts and the wag gap begins to increase. This can be explained by the macroeconomic instability that Ecuador has faced since 2012 (Gachet et al., 2017) Therefore, we show that in fact there exist other factors, different from the structural ones (education, demography, familial factors, type of occupation), that might influence the gender wage gap.

We show that years of education clearly influence the gender wage gap. During the whole period of study, for the selected group of study, women have higher education attainment than men. As women have more years of education and the education gap becomes more negative, the gender wage gap diminishes. Therefore, it is proved that as women receive more education they are prone to earn higher wages. However, even though this affects positively to equality in the Ecuadorian labor market, the gap continues to exist. A possible explanation is that, similarly to the international division of labor, in Ecuador there are more women engaged in domestic activities which are char-

acterized by lower wages. Moreover, inequality will continue to exist in Ecuadorian labor market as long as women continue to participate more than men in non-remunerated activities.

Moreover, this paper's distribucional analysis shows that women's income variance is higher than men's. While men are likely to have similar incomes or at least earnings that are near the average, women tend to have more divergent incomes in the center of the distribution. There is a large group of women with relatively high earnings and another with relatively low income compared to women's average income. Men's incomes are highly concentrated around the mean resulting in a higher central peak and a narrower distribution. Women's earnings are highly spread resulting on a lower central peak and a wider distribution. Kurtosis and skewness explain the behavior of the obtained distributions, men having higher kurtosis and lower skewness than women for the whole period of study.

Finally, in terms of the distribution of years of education, the distributions are not that different for men and for women. However, women's years of education variance is higher than men. Therefore, kurtosis in this case shows a similar but less evident behavior as for income. Men's distribution has a higher kurtosis than women's since years of education for men are more concentrated around the mean while for women data is spread over a wider range. For women skewness is always negative showing that data is highly concentrated on the right and that there are extreme values at the left, while for men the sign varies among the period of study.

This paper provides important insights into the distributions of income in Ecuador and their evolution over time. However, there is more work ahead in this field in order to provide a complete perspective on wage distributional gaps. Future steps regarding this topic include "Unconditional Quantile Regressions" developed by Firpo et al. (2009).

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